SEMESTER END EXAMINATION APRIL-MAY, 2026

Course Name: - B.Tech **Semester:-** 2^{nd}

Paper Name: - Engineering Mathematics-II **Paper Code:-** NBS-202

Time - 3 Hrs + 20 minutes per hour extra time for V.I. & examinees with writer. **Max Marks-70**

Instructions:

- The question paper consists of three sections namely A, B, C. All sections are compulsory.
- Section A- Each question carries **3 mark. All questions are compulsory.**
- Section B- Answer any **5 out of 7** given questions. Each question carries **7 marks.**
- Section C- Answer any **2 out of 3** given questions. Each question carries **10 marks.**

Section - A
Multiple Choice Questions

1. Answer all the following questions. **5x3 =15**

i) The partial differential equation $y\frac{\partial^2 u}{\partial x^2} + 2x\frac{\partial^2 u}{\partial x \partial y} + y\frac{\partial^2 u}{\partial y^2} = 0$ is hyperbolic if

a) $x^2 > y^2$
b) $x^2 < y^2$
c) $x^2 + y^2 > 1$
d) $x^2 + y^2 = 1$

ii) Particular integral of $(D^2 - D'^2)z$ is

a) $\frac{x}{2}cos(x+y)$
b) $xsin(x+y)$
c) $ycos(x+y)$
d) $\frac{x}{2}sin(x+y)$

iii) The Inverse Fourier sine transform of a function $F(s)$ is

a) $f(x) = \frac{1}{\sqrt{2\pi}}\int_0^\infty F(s).\sin sx\, ds$
b) $f(x) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^\infty F(s).\sin sx\, ds$
c) $f(x) = \sqrt{\frac{2}{\pi}}\int_0^\infty F(s).\sin sx\, ds$
d) $f(x) = \sqrt{\frac{2}{\pi}}\int_{-\infty}^\infty F(s).\sin sx\, ds$

iv) $L^{-1}(\frac{1}{s}) =$

a) $u(t-1)$
b) $u(t+1)$
c) $u(t)$
d) $u(\frac{t}{2})$

v) The polynomial $2x^2 + x + 3$ in terms of Legendre Polynomials is

a) $\frac{1}{3}(4P_2 - 3P_1 + 11P_0)$
b) $\frac{1}{3}(4P_2 + 3P_1 - 11P_0)$
c) $\frac{1}{3}(4P_2 + 3P_1 + 11P_0)$
d) $\frac{1}{3}(4P_2 - 3P_1 - 11P_0)$

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Section – B
Short Answer Questions

2. Answer any five of the following questions. **5x7=35**

i. Solve $r - 3s + 2t = e^{2x-y} + e^{x+y} + cos(x + 2y)$.

ii. The vibrations of an elastic string is governed by the partial differential equation $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$. The length of string is π and the ends are fixed. The initial velocity is zero and the initial deflection is $u(x, 0) = 2(sinx + sin3x)$. Find the deflection $u(x, t)$ of the vibrating string for $t \geq 0$.

iii. Find the Laplace transform of $L\{erf\sqrt{t}\}$ and hence prove that $L\{t.erf\sqrt{t}\} = \frac{(3s+8)}{s^2(s+4)^{3/2}}$.

iv. Given that $f(x) = x + x^2$, $for - \pi \leq x \leq \pi$, find the Fourier expression of $f(x)$.

Deduce that $\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \ldots\ldots$

v. Find the Fourier transform of $e^{-ax^2}, a > 0$ and hence find the Fourier transform of $e^{-x^2/2}$ and e^{-x^2}.

vi. Write the Charpit's auxiliary equation and find a complete integral of $px + qy = pq$ by Charpit method.

vii. Write and prove that Rodrigue's formula.

Section – C
Descriptive Questions

3. Answer any two of the following question. **2x10=20**

i) **(a)** Find the general solution of $x(z^2 - y^2)p + y(x^2 - z^2)q = z(y^2 - x^2)$.
(b) Prove that $J_{-n}(x) = (-1)^n J_n(x)$.

ii) **(a)** Find the solution of wave equation $\frac{\partial^2 y}{\partial x^2} = h^2 \frac{\partial y}{\partial t}$ such that $y(0, t) = y(l, t) = 0, y(x, 0) = \sin\frac{\pi x}{l}$ by method of variable separable.
(b) Prove that $P_n(1) = 1$.

iii) **(a)** Find the inverse Laplace transform of $\frac{3}{s-2} + \frac{6}{9s^4} + \frac{2s}{s^2+25}$.
(b) Find the Fourier Sine transform of e^{-ax}.

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